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IS 10555 (2002): Exfoliated Vermiculite [CHD 27: Thermal Insulation]

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भारतीय मानक  
अल्पशल्कित वर्मीक्यूलाइट — विशिष्टि  
( पहला पुनरीक्षण )

*Indian Standard*  
EXFOLIATED VERMICULITE — SPECIFICATION  
( *First Revision* )

ICS 71.100.45

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**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

## FOREWORD

This Indian Standard ( First Revision ) was adopted by the Bureau of Indian Standards, after the draft finalized by the Thermal Insulation Material Sectional Committee had been approved by the Chemical Division Council.

Vermiculite — a mica mineral is a magnesium aluminium iron silicate. Exfoliated vermiculite, produced by the application of heat, is generally used for thermal insulation. It is suitable for use in the temperature range of  $-50^{\circ}\text{C}$  to  $750^{\circ}\text{C}$ .

The standard was originally published in 1983. Over the years, usage of vermiculite has increased and found application in new sectors like horticulture and forestry. With a view to upgrade the standard to satisfy the customers need, the Committee has taken up the revision work. In this revision, five grades have been specified based on the particle size instead of four groups in the original standard. Limits of bulk density and particle size have been modified. Requirement of grit content is incorporated and the requirement of sulphur content is brought under the optional requirement.

There is no ISO standard on the subject. This standard has been prepared based on indigenous manufacturers' data.

The composition of the Committee responsible for formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values ( *revised* )'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## Indian Standard

# EXFOLIATED VERMICULITE — SPECIFICATION

## ( First Revision )

### 1 SCOPE

This standard prescribes the requirements and methods of sampling and test for exfoliated vermiculite loose fill insulation.

### 2 REFERENCES

The Indian Standards listed below contain provisions which through reference in this text, constitute provisions of this Indian Standard. At the time of publication, the editions indicated were valid. All standards are subject to revisions, and parties to agreements based on this Indian Standard are encouraged to investigate the possibility of applying the most recent editions of the Indian Standards.

IS No.	Title
460 ( Part 1 ) : 1985	Test sieves : Part 1 Wire cloth test sieves ( <i>third revision</i> )
3069 : 1994	Glossary of terms, symbols and units relating to thermal insulation materials ( <i>first revision</i> )
3144 : 1992	Mineral wool thermal insulation materials — Methods of test ( <i>second revision</i> )
3346 : 1980	Method for determination of thermal conductivity of thermal insulation materials ( two slab guarded hot plate method ) ( <i>first revision</i> )
4905 : 1968	Methods for random sampling

### 3 TERMINOLOGY, SYMBOLS AND UNITS

For the purpose of this standard, the definitions of terms, symbols and units given in IS 3069 shall apply.

### 4 GRADES

The material shall be any of the following five grades:

- a) Grade 1 — Coarse,
- b) Grade 2 — Medium,
- c) Grade 3 — Fine,
- d) Grade 4 — Superfine, and
- e) Grade 5 — Micron.

### 5 REQUIREMENTS

#### 5.1 General

The exfoliated vermiculite shall be produced by the application of heat to the natural ore at a temperature range of 870°C to 1 000°C. It shall not contain any extraneous material.

#### 5.2 Incombustibility

The material shall not burn or spark when comes in contact with an embedded glowing platinum wire in an oxygen atmosphere.

#### 5.3 Solubility

The material shall not contain more than 0.1 percent by mass of matter soluble in carbon tetrachloride, when determined by the method prescribed in 19 of IS 3144.

#### 5.4 Moisture Content

The material, as received, shall not contain more than 2.0 percent moisture by mass, when determined by the method prescribed in 14 of IS 3144 except that not less than 25 g of the material weighed accurately shall be taken, well spread on a tray, for drying.

#### 5.5 Particle Size

Particle size of the material for all grades shall be such that minimum 80 percent shall be retained between the IS sieves as specified in Table 1 [ *see IS 460 ( Part 1 )* ].

#### 5.6 Bulk Density

When tested in accordance with the method prescribed in Annex A, the bulk density of the material shall be as given in Table 1.

**Table 1 Requirements of Particle Size and Bulk Density**

Sl No.	Grade	Particle Size mm	Bulk Density kg/m <sup>3</sup>
(1)	(2)	(3)	(4)
i)	1	2.60 — 8.0	56-120
ii)	2	1.40 — 4.0	64-128
iii)	3	0.71 — 2.0	72-136
iv)	4	0.355 — 1.0	80-144
v)	5	0.25 — 0.71	96-160

### 5.7 Thermal Conductivity

Thermal conductivity of the material shall not exceed 0.059 W/m.K, when determined in accordance with the method prescribed in 11 of IS 3346.

### 5.8 Moisture Absorption

The material shall not gain in mass by more than 2 percent when tested by the method prescribed in 15 of IS 3144 except that about 50 g of the material, weighed accurately, shall be taken for conducting the test and suspended in the humidity chamber in a container made of wire mesh.

### 5.9 Grit Content

The material shall not have non exfoliates content more than 15 percent by mass for grade 5 and 10 percent for other grades.

### 5.10 Optional Requirement

If required by the purchaser, the material shall also comply with the optional requirements given in 5.10.1 and 5.10.2.

#### 5.10.1 Sulphur Content

The material shall not contain more than 0.5 percent of sulphur when determined by the method prescribed in 19 of IS 3144.

#### 5.10.2 Chloride Content

The material shall not contain more than 50  $\mu\text{g/g}$  leachable chlorides when tested as prescribed in 26 of IS 3144.

## 6 PACKING AND MARKING

### 6.1 Packing

The material shall be packed in polyethylene-lined or paper-lined hessian bags of 10, 12.5, 15, 20, 25 or 30 kg capacity or as agreed to between the purchaser and the supplier.

### 6.2 Marking

The packages shall be legibly and indelibly marked with the following information:

- a) Manufacturer's name and recognized trade-mark, if any;
- b) Batch number or month and year of manufacture;
- c) Net mass;
- d) Grade of the material; and
- e) Name of material.

6.2.1 Each package of exfoliated vermiculite may also be marked with the Standard Mark.

6.2.1.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## 7 SAMPLING

Representative samples of the material shall be drawn and their conformity determined in accordance with the method prescribed in Annex B.

## ANNEX A

( Clause 5.6 )

## DETERMINATION OF BULK DENSITY

## A-1 PRINCIPLE

A-1.1 Bulk density of the material is determined by filling a measure of known volume and weighing the insulation.

## A-1.2 Number of Tests

Carry out three determinations using fresh material each time.

## A-1.3 Apparatus

## A-1.3.1 Bulk Density Measure

A light weight rigid cubic box with internal dimension of about 300 mm.

## A-1.3.2 Balance

Balance with an accuracy of at least one percent of the mass of sample to be weighed.

## A-1.4 Procedure

Fill the measure to overflow with a shovel or scoop,

discharging the insulation from a height of 50 mm above the top of the measure. Take care to prevent, as far as possible, segregation of the particle sizes of which the sample is composed. Level off the surface of the insulation in such a way that any slight projection of the larger pieces of the coarse insulation approximately balance the larger voids in the surface below the top of the measure. Take care not to compact the sample. Determine the net mass of the insulation.

## A-1.5 Calculation

Calculate bulk density as follows:

$$\text{Bulk density, kg/m}^3 = \frac{M}{V}$$

where

$M$  = net mass of the insulation, kg; and

$V$  = volume of the measure,  $\text{m}^3$ .

## ANNEX B

( Clause 7 )

## SAMPLING

## B-1 SCALE OF SAMPLING

## B-1.1 Lot

All the bags of the material belonging to the same batch of manufacture, in a single consignment, shall be grouped together and each such group shall constitute a lot.

B-1.2 For ascertaining the conformity of the lot to the requirements of this specification, tests shall be carried out on each lot separately.

B-1.3 The number of bags to be selected ( $n$ ) shall depend on the lot size ( $N$ ) and shall be in accordance with Table 2.

B-1.3.1 These bags shall be selected at random. In order to ensure the randomness of selection, random sampling procedures given in IS 4905 may be adopted.

Table 2 Number of Bags to be Selected for Sampling

( Clause B-1.3 )

Sl No.	Lot Size (2)	No. of Bags to be Selected	
		$N$	$n$ (3)
(1)	Up — 200		5
i)	201 — 300		6
ii)	301 — 500		7
iii)	501 — 800		8
iv)	801 — 1 300		9
v)	1 300 and above		10

## B-2 PREPARATION OF TEST SAMPLE AND NUMBER OF TESTS

B-2.1 From each of the bags selected according

to B-1.3, approximately equal quantity of the material shall be taken preferably by means of a scoop or suitable sampling tube and thoroughly mixed to form a composite sample weighing not less than 2 kg which would be sufficient for carrying out triplicate determination of all characteristics given in 5.

**B-2.1.1** The composite sample shall be divided into three equal parts, one for the purchaser, another for the supplier and the third to be used as the referee sample.

**B-2.1.2** These three parts of the composite sample shall be transferred to separate sample bags. These bags shall be properly stitched, and labelled with full identification particulars.

**B-2.1.3** The referee test sample shall bear the seal of both the purchaser and the supplier. It shall be kept at a place agreed to between the purchaser and the supplier to be used in case of any dispute between the two.

**B-2.2** Tests for determination of all characteristics given in 5 shall be conducted on the composite sample.

### **B-3 CRITERIA FOR CONFORMITY**

**B-3.1** The lot shall be declared as conforming to the requirements of this specification if all the test results on the composite sample satisfy the corresponding requirements given in 5.

**ANNEX C**  
**( *Foreword* )**  
**COMMITTEE COMPOSITION**

**Thermal Insulation Sectional Committee, CHD 27**

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